REMARKS

Claims 1-9 and 11-19 stand in the present application. Reconsideration and favorable action is respectfully requested in view of the following remarks.

In the Office Action, the Examiner has rejected claims 1-9 and 11-19 under 35 U.S.C. § 103(a) as being unpatentable over Gerard in view of Budisin. Applicant respectfully traverses the Examiner's § 103 rejection of the claims.

A key distinction of Applicant's invention over the cited art is the way in which Applicant computes the Fourier transform of the reference sequence - this is expressed, for example in the final two lines of claim 1: "computing the Fourier transform of the reference sequence comprises an iterative process of combining the Fourier transforms of a shorter starting sequence." It is this step which enables the very useful feature provided by the present invention of being able to calculate components of the reference signal in the frequency domain at frequencies that do not correspond to the sampling frequency used in the reference signal. This is necessary in order to be able to multiply together, in the frequency domain, frequency components computed from a sequence of samples taken from the received signal to be filtered (conveniently using a Fast Fourier Transform method) when the sampling of the received signal to be filtered has been performed periodically with period, tau, (which differs from the

period between samples, lambda, of the reference signal) with frequency components of the reference signal at the same frequencies (i.e., as obtained by performing a Fourier Transform (conveniently done using a Fast Fourier Transform) of the sampled received signal to be filtered. Clearly, in order to be able to perform this "trick" the method of computing the Fourier transform of the reference signal needs to take explicit account of both the sample interval of the reference signal and the sample interval of the received signal to be filtered. That this is the case can be seen from the equations on page 5 of the present specification from which it can be seen that $\Phi_0 = 1/2\ \lambda$ and the f's can take any value (i.e., including the values for f for which the FFT calculates frequency components for the sampled received signal to be filtered).

In contrast, Gerard is a completely analog device based on the entirely analog SAW chirp filter components. In general analog signal processing is a totally separate field to digital signal processing and it is rare that a person skilled in the art of analog signal processing would consider documents in the art of digital signal processing or vice versa. Moreover, there is no motivation for a person skilled in the art of either discipline to try and combine together the teachings of the two very different documents currently being relied upon by the Examiner.

In any event, since Gerard concerns an entirely analog device, it does not disclose the use of any sampling. In other words, it fails to disclose the first claim feature of "a method of matched filtering in accordance with a reference signal sequence comprising a plurality of signal samples at regular sampling time intervals λ." The Examiner refers to the Abstract and column 2, lines 41-64 of Gerard as teaching this, but in fact there is, unsurprisingly, no mention of use of a reference signal sequence as claimed or of any kind of sampling since no sampling or digital processing of any sort is carried out in Gerard.

Similarly, Gerard also fails to disclose "sampling the input time domain signal r(t), at sampling time intervals τ that are not synchronized to the sampling intervals λ of the reference signal sequence, to produce an input signal sequence." The Examiner refers to column 1, lines 51-62, and column 3, lines 24-51, and Gerard as teaching this, but again, unsurprisingly, since Gerard operates entirely in the analog domain, there is no actual teaching of carrying out any sampling of any signals to generate any sequences, rather all signals in Gerard (input, reference, output etc.) are all kept as analog signals and are not sampled to generate sequences at any stage whatsoever. Indeed, Gerard at column 3, line 48, points out that the signals output from the chirp filters are

connected to an analog multiplier, which would only be possible if the processed signals were still in the analog domain.

Similarly, Gerard also fails to disclose "computing the Fourier transform of the input signal to be filtered at discrete frequencies f determined by the intervals τ at which the input signal is sampled." Rather in Gerard the Fourier transform is generated over a continuous frequency interval and not at discrete frequencies f. Again the referenced portion of Gerard (column 4, lines 14-29) does not disclose anything suggestive of digital signal processing.

Similarly, Gerard also fails to disclose "computing the Fourier transform of the reference sequence, evaluated at the same discrete frequencies f" for the same reasons that Gerard is performing analog processing and so there is no suggestion of discrete frequencies or the use of any sequences (i.e., digitally represented samples of a signal). The portion of Gerard referred to be the Examiner as teaching this feature (column 3, line 52 - column 4, line 14) actually states "all of the circuitry subsequent to the bandpass filter constitutes the inverse analog transform circuitry" which again reinforces the point that all of this processing is being performed in the analog domain.

The Examiner concedes (correctly) that Gerard discloses neither "wherein the reference sequence is defined as a function of time by a process of iteratively

combining shifted versions of shorter sequences" nor "wherein computing the Fourier transform of the reference sequence comprises an iterative process of combining the Fourier transforms of a shorter starting sequence." However, the Examiner alleges that both of these features are disclosed in Budisin. Applicant concedes that Budisin does indeed use reference signals which are defined as a function of time by a process of iteratively combining shifted versions of shorter sequences" however these reference sequences are then used within a Finite Impulse Response (FIR) matched filter. Although the Z transform of this filter is considered, this is done because according to conventional FIR analysis this is how one determines the transfer function of the filter which is the key design factor when designing an FIR (or an IIR). Nonetheless, in implementing an FIR one uses tap weights or "taps" to specify the properties of the filter and these must relate to the reference signal and correspond to equivalent sample times of the reference signal compared to the signal to be filtered (see present specification at page 2, lines 26-29). Since Budisin uses an FIR matched filter, it is necessary that the reference signal sample interval must be the same as the input signal sample interval.

Since Budisin uses an FIR matched filter, however, there is no disclosure in Budisin of "wherein computing the Fourier transform of the reference sequence

comprises an iterative process of combining the Fourier transforms of a shorter starting sequence." Rather in Budisin, because it uses an FIR, the FIR performs multiple things at the same time. In essence it simultaneously transforms both the reference signal and the input signal into the frequency domain and multiplies them together - all three operations happening simultaneously. This very efficient processing however has the requirement that the sequences representing the reference and input signals need to be compatible - i.e., they need to have been obtained by sampling the respective signals at the same sampling intervals - i.e., λ and τ need to be the same. In essence, what is occurring in Budisin is that the filter has been designed based on the insight that the reference sequence of the reference signal can be defined as a function of time by a process of iteratively combining shifted versions of shorter sequences and that this therefore leads to an efficient FIR filter. This is directed to the particular field of interest to Budisin (radar pulse compressing). Nonetheless, there is no appreciation that a process of iteratively combining the Fourier transforms of shorter starting sequences could have the significant technical benefits of Applicant's invention (most particularly in a slightly different application of matched filters - namely in telecommunications applications where different oscillators may be used to sample the input signal as are available

locally). In particular, it is important to note that the discussion in Budisin of FFT's at the paragraph on page 220 commencing "An alternative implementation ..." refers to the FFT approach merely as a comparison to the described approach. There is no suggestion that the interesting properties of Golay sequences should be exploited in such an approach in any way, nor that it would enable different values of 1 and t to be used, nor indeed that the way in which to enable such different values of 1 and t to be used would be to iteratively generate the Fourier transforms of the reference sequences by means of "iteratively combining the Fourier transforms of a shorter starting sequence" as claimed by Applicant. Rather it just assumes that a conventional FFT process be used to generate the Fourier transforms of the respective input and reference signals (the purpose for doing this is that it is noted by the author that his proposed Fast Golay Correlation (FGC) algorithm achieves the same improvement over a "correlator implemented in a straightforward manner" as "the improvement of the FFT algorithm compared to the DFT algorithm" and so it is interesting to note whether one could simply exploit the relative efficiency of an FFT algorithm to achieve the same gains as provided by the FGC algorithm and the author simply wants to assure readers that this is not in fact the case).

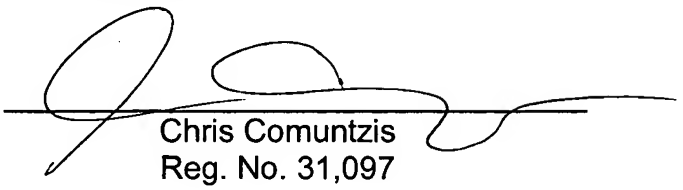
In conclusion, it is clear that the final feature of independent claims 1 and 13 is not taught or suggested by Budisin or Gerard, taken singly or in combination, nor indeed by any of the prior art documents of which the Applicant is aware. Furthermore, there is no possibility of combining Budisin and Gerard in any meaningful way since Gerard is concerned with analog processing techniques whilst Budisin is concerned with digital processing techniques. Finally, neither Gerard nor Budisin is concerned with the approach of performing matched filtering using a three stage process of separately converting the input signal to the frequency domain and then the reference signal to the frequency domain and then multiplying the two separately converted signals together before reconverting them back to the time domain, all of this being performed in the digital domain. Rather, in Gerard the whole process is performed in the analog domain, whilst in Budisin an FIR filter is used to perform all three operations of conversion of the input and reference signals into the frequency domain and multiplying these together simultaneously. There is no reasonable way in which these very different techniques can be combined to arrive at the present invention, nor, based on reading Budisin and/or Gerard, of finding any motivation to do so.

Accordingly, for all of the above reasons, it is respectfully submitted that claims 1-9 and 11-19 patentably define over the cited references taken either singly or in combination.

Therefore, in view of the above amendments and remarks, it is respectfully requested that the application be reconsidered and that all of claims 1-9 and 11-19, standing in the application, be allowed and that the case be passed to issue. If there are any other issues remaining which the Examiner believes could be resolved through either a supplemental response or an Examiner's amendment, the Examiner is respectfully requested to contact the undersigned at the local telephone exchange indicated below.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: 

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